Draft

Lake Okeechobee Water Retention/Phosphorus Removal Project -

Taylor Creek (Grassy Island) Stormwater Treatment Area (STA)

Water Control Plan

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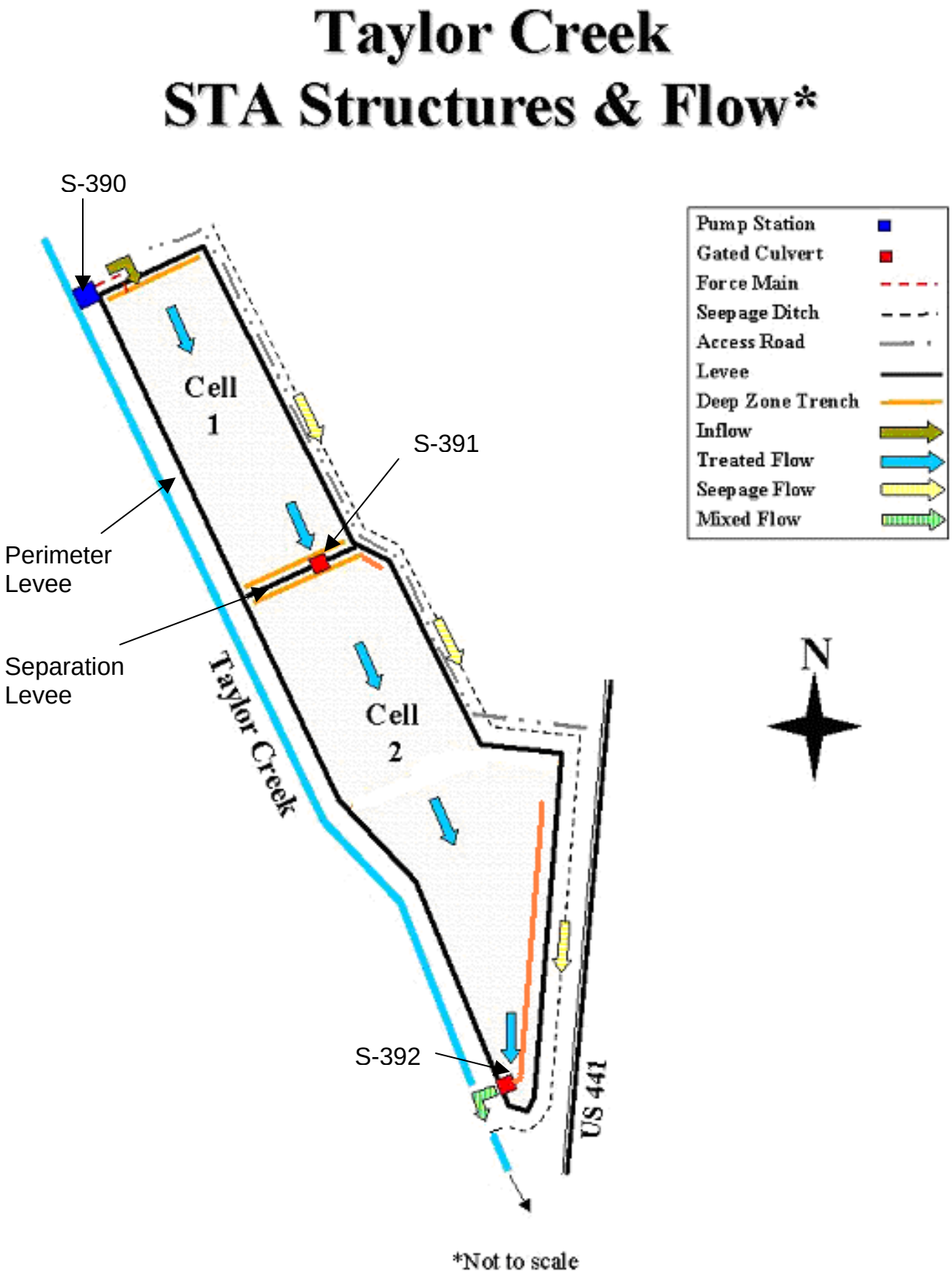
Figure 1


Stanley Consultants INC.
Okeechobee
213
PROJECT LOCATION
Dixie Ranch Acres
TAYLOR CREEK SITE
214
248 and ARS 11
Whispering Pines
Bassweod Estates
Okeechobee County
Barber Quarters
Cypress Quarters
Okeechobee
241
NUBBIN SLOUGH SITE
252
Sherman
228
S191
LAKE OKEECHOBEE
Chandler Hammock Slough
Turkey Slough
Popash Slough
Eagle Bay
Lonkin Creek
N
214 WATER QUALITY MONITOR LOCATIONS
SCALE: 1 = 126720 (1" = 2 MILES)
Site Location

Figure 2


Taylor Creek
STA Structures & Flow*
S-390
Cell 1
S-391
Perimeter Levee
Separation Levee
Taylor Creek
Cell 2
S-392
US 441
Pump Station
Gated Culvert
Force Main
Seepage Ditch
Access Road
Levee
Deep Zone Trench
Inflow
Treated Flow
Seepage Flow
Mixed Flow
N
*Not to scale

7.01 Introduction.

A. Water Control Plan Development. The main purpose of a water control plan is for day-to-day use in water control for essentially all foreseeable conditions affecting a project. Report preparation is pursuant to Engineering Regulation 1110-2-240, and is in accordance with guidance contained in Engineering Manual 1110-2-3600 and Engineering Regulation 1110-2-8156. The Startup Phase is initiated after the completion of the Taylor Creek Stormwater Treatment Area(STA). During this phase water levels will be regulated to encourage vegetation establishment and to prevent discharge from treatment Cell 2 until the start-up criterion as identified in the Taylor Creek STA Lake Okeechobee Protection Act (LOPA) Permit is met. This water control plan will be included as an appendix to the Lake Okeechobee Operating Manual. All elevations referenced in this draft water control plan are in feet, National Geodetic Vertical Datum of 1929 (NGVD), unless otherwise stated.

B. Background. This project is one of the Critical Restoration Projects authorized by Section 528 of the Water Resources Development Act of 1996. A list of Critical Projects was proposed and then prioritized and ranked by the South Florida Ecosystem Restoration Working Group. The Governor's Commission recommended that priority be given to this phosphorus removal project that was ranked 10^{th} on the list of Critical Projects. The sponsor for the project is the South Florida Water Management District (SFWMD).

7.02. General Objectives.

The goal of the Taylor Creek STA is to capture and treat stormwater from the Taylor Creek Basin, upstream of the STA, prior to discharge back into Taylor Creek and on to Lake Okeechobee. The water quality treatment function is primarily to reduce the mass and concentration of Total phosphorus (TP) in Taylor Creek. Taylor Creek is degraded because of high nutrient loading from agricultural runoff. The average phosphorus concentration in Taylor Creek runoff is approximately 600 parts per billion (ppb). This greatly exceeds the phosphorus concentration of the receiving water, Lake Okeechobee, which averages 100 ppb. High TP

loads have been implicated in excessive eutrophication of Lake Okeechobee that can result in algal blooms, high sediment oxygen demand, and loss of fisheries and recreational benefits provided by the lake. In addition to the reduction of TP loads, the Taylor Creek STA will provide additional water quality and quantity benefits to downstream waters. The STA will remove suspended solids, dissolved and particulate oxygen-demanding materials, total nitrogen, metals, and pesticides that would otherwise flow into the lake.

7.03. Project Description.

The Taylor Creek STA is adjacent to Taylor Creek approximately 2.4 miles north of the city of Okeechobee. (As shown on Figure 1.) The Taylor Creek STA is on the Grassy Island property which is located immediately northwest of the U.S Highway 441 bridge over Taylor Creek. The southern end of this project is approximately 7 miles from the edge of Lake Okeechobee.

The Taylor Creek Site habitat is fragmented between large areas of pasture, upland forested areas, cypress stand, depressional areas, other forested wetlands etc. The Florida Natural Areas Inventory (FNAI) designates the very southern end of the Taylor Creek Site as an area of conservation interest, in connection with the larger forested wetlands system in the slough along Taylor Creek. According to the Fish and Wildlife Coordination Act report (CAR) of the U.S. Fish and Wildlife Service (USFWS), the adjacent lands, open pastures with scattered cabbage palms are prime foraging and nesting habitat for Audubon’s crested caracara. The open pasture is also habitat for turkey vulture, sandhill crans, meadowlark, mourning dove, and white-eyed vireo. In addition, the wooded areas (wetland and upland) provide habitat for migratory, as well as resident birds.

The Taylor Creek STA is a long, narrow enclosure, parallel to Taylor Creek (As shown in Figure 2). Inflow to the STA, from Taylor Creek, occurs at the north end of the STA, and flows southeasterly through Cells 1(49 acres) and 2(93 acres) before discharged back to Taylor Creek. The predominant grade within the STA creates flow northwest to the southeast but the general slope of each cell is from east to west, making the water on the west side of the cells deeper than on the east. Some portions of the southeast corner of Cell 2 will remain dry most of the time. This area was included in the STA to avoid

constructing the perimeter berm through stands of cypress. Deep zone trenches at the inflow and outflow of each cell are designed to help distribute flow evenly throughout the cell.

7.04. Project Features.

Physical features for the Taylor Creek STA include perimeter levees, separation levee, deep zone trenches, seepage ditch, downward opening slide gate culverts 391 and 392 (S-391 and S-392) with gate wells, and Structure 390 (S-390), an inflow pump station. (Please refer to Figure 1 for a diagram of the Taylor Creek STA and the project features.) S-390 may be operated remotely from S127 Control Center or on site at the control building. Inflow to the system will be determined by the manufacturer's pump curves and head determined from water levels transmitted from sensors upstream of the pump station and at the discharge of the force main.(please refer to Figure 3 for the location of the sensors). A water level sensor, on the upstream side of the separation levee will provide information on the slope of the water surface across the site, an indirect indication of the resistance to flow and thus the degree of vegetation within the cell. A gate level sensor, monitored in conjunction with the water level sensors will provide information necessary to estimate discharge from Cell 1 to Cell 2. A similar arrangement of water and gate level sensors at the outfall of Cell 2 will enable estimation of effluent discharge. The three flow measurements, one at the inflow to Cell 1, one at the separation levee, and one at the STA discharge point, in conjunction with local rainfall measurements, will enable the SFWMD to determine quantities of water treated and combined losses from seepage and evapotranspiration.

A. S-390. S-390 is a pump station with four parallel submersible, centrifugal pumps. The pumps will primarily operate based on an existing water level sensor on Taylor Creek approximately 125 feet upstream of the pump station. The pumps will operate to maintain a water level in the creek between 17.0 and 20.0 ft. The available flow in Taylor Creek at Grassy Island usually exceeds capacity of the STA for optimal phosphorus removal. The design peak flow pumping rate is 24 cfs. To achieve this pumping rate, the design requires four 14 horsepower (Hp) submersible, centrifugal pumps. The pumping rates are shown in Table 1.

Table 1.

No. of Pumps Running	**Flow Rate**		**Percentage of Days Available**
	GPM	CFS	
1	2,600	5.8	95
2	5,200	11.6	88
3	7,400	16.5	84
4	9,600	21.4	75

The discharge values are based upon a static head of nine ft. which is near the maximum height that the pumps will operate against.
(Design Analysis Final Submittal, June 2003, Stanley Consultants, Inc.)

B. Interior Culvert(S-391). S-391 is a 3 ft. diameter reinforced concrete pipe culvert with a downward opening slide gate; the water will flow over the gate. This structure is located in the interior levee. The gate will be operated to maintain water depths in Cell 1 between 0.5 and 3.0 ft.

C. Outflow Culvert (S-392). S-392 is also a 3 ft. diameter concrete pipe culvert with a downward opening slide gate; the water will flow over the gate. This culvert is located in the southwest corner of the STA in the perimeter levee. This structure will be operated to maintain water depths in Cell 2 between 0.5 and 2.0 ft as measured by the water sensor upstream of the structure in Cell 2.

D. Levees. The STA is bounded on all sides by a perimeter levee with a separation levee across the mid section of the site providing a separation of Cell 1 and 2. The levee crest elevation is set by the design pool elevation within each cell plus a freeboard allowance to accommodate the 10-year, 24-hour precipitation event, wind shear surge, and wave run-up. The freeboard allowance for both cells is 3 ft., which consist of 6 inches for a 10-year 24-hour event, an estimated 4 inches surge, 1.5 ft. for wave run-up and 8 inches for backwater effects. Hence the crest elevations for Cell 1 and 2 are 28.0 and 27.0

ft., respectively. The design pool elevation for Cells 1 and 2 is 24.6 and 23.6, respectively. The side slopes are 3H to 1V.

E. Deep Zone Trenches. At Taylor Creek STA each cell has an inflow, and outflow, deep zone trench. Deep zone trenches are located in the STA to enhance the even distribution of flow throughout each cell. Deep zone trenches at the inflow of each cell distribute the inflow over a wide area. Deep zone trenches at the outfall collect return flow over a wide area. They average 3 ft. in depth with a 10 ft. bottom and 4H to 1V side slopes.

F. Emergency Overflow Sections. Each treatment cell contains an emergency overflow section on the southwest perimeter levee. When the water elevation reaches 27.0 ft. in Cell 1, water will flow over the emergency overflow section and to Taylor Creek. When the water level reaches 26.0 ft. in Cell 2, water will flow over the emergency overflow section to Taylor Creek.

G. Seepage Ditch. A seepage ditch is located on the eastern side of the STA. The ditch will capture the STA seepage and convey it, via open channel connection, to Taylor Creek. In addition, the slopes and area will be sufficient to convey runoff from storms with a magnitude of a 5-year return period event.

7.05. Constraints.

A. Vegetation Removal. S-390 pumping may be reduced or stopped during activities for performance enhancement related to vegetation removal in the cells. In addition, S-391 may be adjusted to reduce or stop flow to Cell 2.

B. Phosphorus Removal. Discharge from the Taylor Creek STA will not begin until net improvement for phosphorus removal is observed. The 4-week geometric mean measured at the interior site, upstream of S-392, should be less than the 4-week geometric mean measured at the inflow site at Taylor Creek, upstream of S-390.

C. Cell Grade. The predominant grade within the STA creates flow northwest to the southeast, but the general slope of each cell is from east to west, making the water

on the west side of the cells deeper than on the east. Some portions of the southeast corner of Cell 2 will remain dry most of the time.

D. Cypress Trees Acclimation. The cypress tree stand is located within the boundaries of the STA levee. A sudden inundation of water will kill the trees. Therefore, operations may need to be modified to slowly acclimate the trees to the change in water levels.

7.06. Overall Plan for Water Control. S-390 will pump water from Taylor Creek into the Taylor Creek STA Cell 1. Water will flow by gravity in Cell 1 and through S-391 to Cell 2. Water will flow by gravity to S-392 which will discharge the water back to Taylor Creek when the 4-week geometric mean measured at the interior site, upstream of S-392 is less than the 4-week geometric mean measured at the inflow site at Taylor Creek, upstream of S-390.

7.07. A. STA Startup Phase Operations. The goal during STA startup is encouragement of wetland vegetation growth while limiting or minimizing release of dissolved and particulate Total Phosphorus (TP) downstream. The startup operations are intended to avoid the release of any water from the STA until surface water TP concentrations are equal to or below the concentration of TP in source water, Taylor Creek.

S-392 will be closed during the STA startup. S-390 will begin pumping. During periods of excessive rainfall, the inflow pumping will be reduced or stopped. S-391 slide gate height will be adjusted to allow the Cell 2 elevation to reach 25.5 ft. When 25.5 ft. is reached in Cell 2, S-391 will be set at 26.5 ft. When the elevation in Cell 1 reaches, 26.5 ft., S-390 will cease pumping. Once net improvement for phosphorus removal is observed, at water quality sampling site,WQ3, upstream of S-392, with a four week geometric mean less than the 4-week geometric mean of the inflow site (upstream of S-390), the S-392 slide gate will be adjusted to allow the treated flow into Taylor Creek. S-391 will be adjusted to maintain elevations of 24.6 and 23.6 ft. in Cells 1 and 2, respectively, normal operations, Section 7.08, will begin.

7.08. Normal Operations. Normal operations are defined as operations up to and including the design peak flow pumping rate of 24 cfs. S-391 and S-392 will be operated to

provide an average water depth of 2 ft. at the peak flow pumping rate.

7.09. Flood Control. When the Taylor Creek STA water elevation in Cell 1 is greater than 26.5 ft., S-390 pumps will cease pumping. S-391 and S-392 will be adjusted to allow flow over the gate. In addition, emergency overflows are located on the western levees for each cell to allow levee protection if S-391 or S-392 become plugged.

7.10 Pre-storm Drawdown. Pre-storm drawdowns may be based on National Weather Service Advisories and SFWMD forecasts. If storage in the STA can be created by discharging treated water to Taylor Creek prior to the storm event, pre-storm drawdowns may be initiated. Pumping at S-390 will cease for pre-storm drawdown. S-391 will be operated to lower the water level within the STA before a storm arrives and to improve the passage of water during a high rainfall event. S-392 will be open to make releases to Taylor Creek.

7.11. Recreation. An air boat ramp is at the site; however, maintenance and monitoring personnel will mainly use the ramp. SFWMD intends to allow certain types of recreational use in the STA, and is in the process of preparing plans. However, there will not be specific operations to provide for recreation.

7.12. Water Quality. During the startup phase of the STA, water will not be released back to Taylor Creek until a net reduction measured at the interior sample site is less than the 4-week geometric mean TP measured at the inflow site.

7.13. Seepage Control. The seepage ditch is located along the eastern side of the STA. This ditch will collect seepage from the STA and convey it via open channel connection to Taylor Creek through an existing un-gated culvert southeast of S-392. A seepage ditch is not on the western side of the STA. Any seepage on the west will flow to Taylor Creek.

7.14. Fish and Wildlife. There are no operations specifically for fish and wildlife. However, because endangered species and migratory birds have been known to occupy STAs, when possible, operations will be coordinated with USFWS and FFWCC to minimize adverse impacts to nesting migratory birds.

7.15. Water Supply. There are no operations specifically for water supply.

7.16. Drought Operations. Inflows to the STA will continue to the extent possible as water flows in the source stream begin to decline during the onset of a drought. S-391 will be adjusted as necessary to so that Cell 1 water will be transferred to Cell 2. S-392 will operate as necessary to provide the two-foot water depth.

If during the drought period, the cells are out of service for an extended period and invasive upland vegetation is established, Startup Operations will be reinitiated.

7.17. Deviation from Normal Operation. The United States Army Corps of Engineers (USACE), Jacksonville District Engineer is occasionally requested to deviate from the normal regulation of the project. Prior approval for a deviation is to be obtained from the Jacksonville District Office (SAJ) except as noted below. The Jacksonville District Office will in turn obtain the necessary approvals from the South Atlantic Division (SAD) except as noted below. Deviation requests usually fall into the following categories:

A. Emergencies. Some emergencies that can be expected include drowning and other accidents, failure of project facilities, and flushing of pollutants. Antecedent conditions, as well as forecasted storm events, may result in SFWMD declaring an Emergency Authorization Order which would result in an Emergency Deviation. Necessary action under emergency conditions is taken immediately, unless such action would create an equal or worse condition. The Jacksonville District Office should be informed as soon as practicable. Written confirmation should be furnished after the incident. SAJ will report these deviations to SAD.

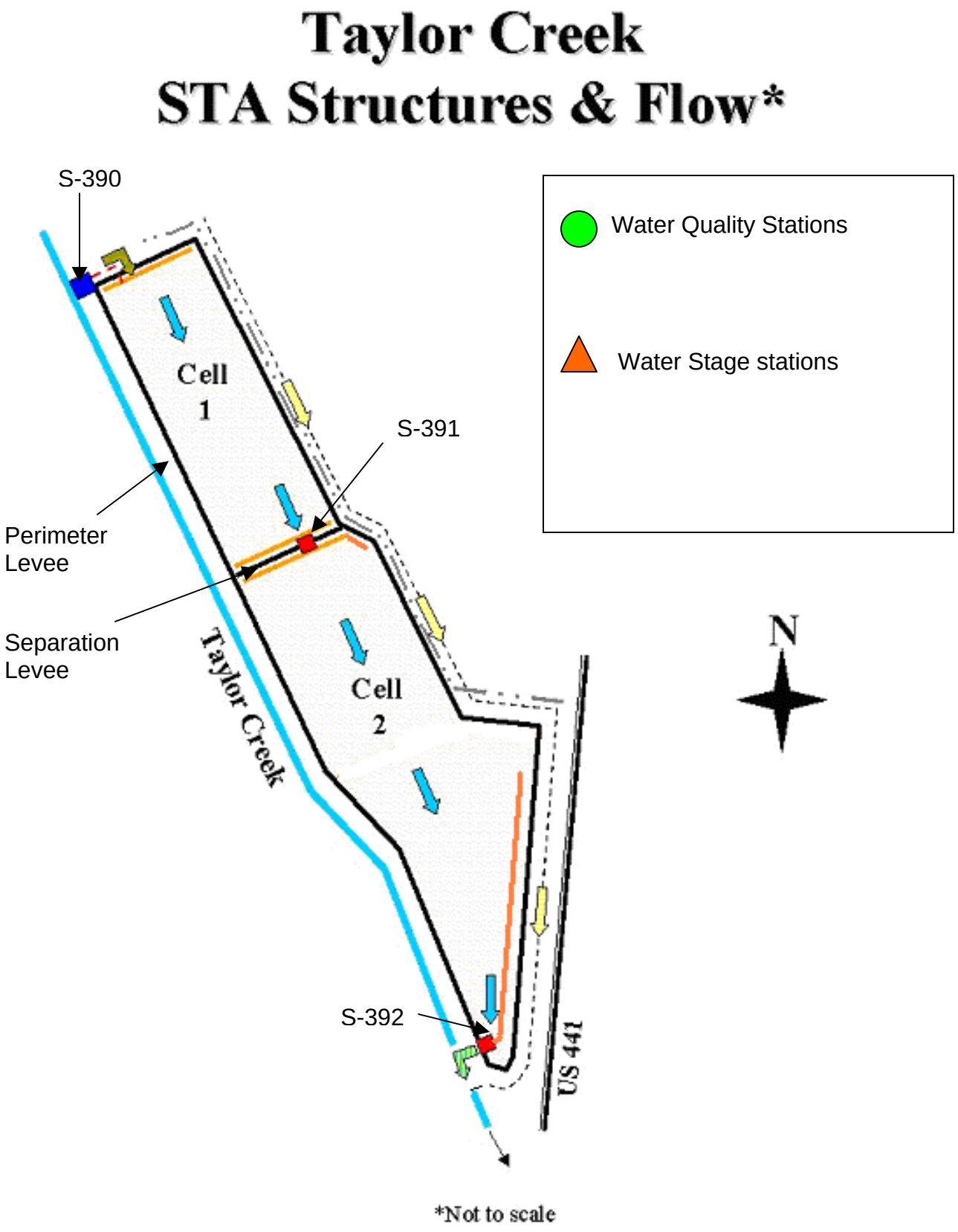
B. Unplanned Minor Deviations. There are unplanned instances where there is a temporary need for a minor deviation from normal regulation, although they are not considered emergencies. A change in releases is sometimes necessary for construction, maintenance, or inspection. These requested deviations are usually for duration of a few hours to a few days. Each request is analyzed on its

own merits. Consideration is given to upstream watershed conditions, potential flood threat, conditions of lakes, and possible alternative measures. In the interest of maintaining good public relations, the request is complied with, providing there are no adverse effects on the overall project regulation for authorized project purposes. Approval for minor deviations will normally be obtained from the Jacksonville District by telephone. A written confirmation will be furnished after the deviation is completed. SAJ will report these deviations to SAD.

C. Planned Deviations. Each condition should be analyzed on its own merits. Sufficient data on flood potential, lake and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes will be presented to the Jacksonville District along with recommendations for review and approval. SAJ will report these deviations to SAD and obtain approval.

7.18 Monitoring. Data will be collected to monitor flow rates and phosphorus removal rates within the STA. Inflow to the system will be determined by the manufacturer's pump curves and head determined from water levels transmitted from sensors upstream of the pump station and at the discharge force main. A water level sensor on the upstream side of the separation levee will provide information on the slope of the water surface across the site, an indirect indication of the resistance to flow and thus the degree of vegetation within the cell. A gate level sensor, monitored in conjunction with the water level sensors will provide information necessary to estimate discharge from Cell 1 to Cell 2. A similar arrangement of water and gate level sensors at the outfall of Cell 2 will enable estimation of total discharge. The three flow measurements, one at the inflow, one at the separation levee, and one at the discharge end of the STA, in conjunction with local rainfall measurements, will enable the district to determine quantities of water treated and combined losses from seepage and evapotranspiration. See Figure 3 for the location of the sensors.

Figure 3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